FINAL REPORT

THE ENDANGERED ARIZONA WATER SHREW

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INTRODUCTION

Prior to 1985, the Arizona population of the northern water shrew, ***Sorex palustris navigator***, was known from only 3 specimens trapped in the White Mountains. From 1985 to the present, 8 additional specimens have been trapped in the White Mountains region. In September of 1985 and 1987, Andrew T. Smith of Arizona State University took 2 water shrews both at Fish Creek and State Highway 260. The remaining 6 shrews were taken as a result of intensive survey efforts by John Hanna of the Arizona Game and Fish Department and Gregory Hocutt of Arizona State University during the summers of 1992 and 1993 respectively. ***Sorex palustris navigator*** is already listed as a sensitive form ("State Endangered") by the Arizona Game and Fish Department and is a species of special interest to the Apache-Sitgreaves National Forest, USFS. Given the apparently limited distribution and abundance of the water shrew in Arizona and its close affiliation with highly sensitive riparian habitats, successful management of the population in Arizona will require a comprehensive assessment of its full distribution, habitat affinities and population status. Based upon such a limited sample size (n = 11), accurate analysis of the population status in Arizona is difficult. This report, therefore, summarizes the sampling which has occurred to date, attempts to evaluate the potential distribution and habitat requirements of the Arizona water shrew, and reviews some implications which current data may have on future management of the population.

BACKGROUND

The water shrew, ***Sorex palustris***, is known to occur widely in swift flowing, boreal streams throughout the northern and montane United States and Canada. The Arizona subpopulation of ***Sorex palustris navigator*** in the White Mountains is highly isolated from the main distributional range of the subspecies -- the nearest known neighboring populations being some two hundred miles to the northeast in New Mexico and some three hundred sixty miles north in Utah (Hoffmeister, 1986). Water shrews are associated with swift flowing, perennial, boreal streams which provide substantial cover in the form of willows and shrubs, tall grasses and forbs, roots, crevices and overhanging banks (Baker, 1983; Banfield, 1974; Conaway, 1952). A study by Clark (1973) indicated that water shrews were most common in habitats of approximately seventy-five percent (75%) ground cover (Beneski and Stinson, 1987, citing: Clark, 1973). Beaver (*Castor canadensis*) activities also may facilitate water shrews through creation of appropriate local habitat (Wrigley et al., 1979). Water shrews have occasionally been trapped in slower moving streams and even in dry, ephemeral creek beds (Kinsella, 1967). Their diet consists largely of small fish, insects and other invertebrates, some plant material and small mammals (Beneski and Stinson, 1987). Densities of water shrews are believed to be low (home ranges of 0.2 to 0.3 ha.) compared to other shrews and many small mammals (Beneski and Stinson, 1987, citing: Buckner and Ray, 1968; Kirkland and Schmidt, 1982; Nagorsen and Peterson, 1981).

The most significant current threat to the Arizona water shrew population may be livestock grazing due to its potentially deleterious effects on riparian areas. These effects include change in vegetation communities, soil compaction and loss of cover through grazing, trampling and destruction of overhanging banks (Kauffman and Krueger, 1984). No work on

the specific impact of various grazing regimes on the Arizona water shrew has been accomplished at this time, due in part to limited information on its actual distribution in the White Mountains. Restriction of the water shrew largely to swift running, perennial, boreal streams suggests that the Arizona population may occur in a very limited and fragmented range. Given the close association between the water shrew and high elevation riparian habitats, commercial uses of water shrew habitat such as grazing, if not carefully controlled, could easily lead to degradation and possible destruction of much of that habitat in the White Mountains. Foreseeable negative impacts would include an increase of both habitat loss and fragmentation leading, in turn, to reduced vagility and an increased vulnerability of the population to a deterministic and/or stochastic extinction event. Successful management of the population will require 1) further assessment of the range and habitat requirements of the subspecies in Arizona, 2) efforts to maintain existing subpopulations and habitat, and 3) possible restoration of suitable habitat to increase the population's range and density, and to facilitate dispersal. The current report provides data regarding the first of these requirements and information useful to all three management goals.

METHODS

From 25 May through 19 September, 1993, trapping was conducted along 12 riparian zones on 11 drainages in the White Mountains region of the Apache National Forest. Water shrews have been trapped in the White Mountains using pitfall traps (Hanna, unpublished data) and Shermann live traps (Smith, unpublished data). Water shrews are generally trapped within 1 foot of water (Conaway, 1952; Hoffmeister, 1986). In order to trap as close to the edge of these drainages as reasonably possible and in order to cover a substantial linear distance along each stream, small Shermann live traps (5.08 cm X 6.35 cm X 16.51 cm) were set every 3 to 6 meters along the stream bank (as suitable horizontal substrate permitted) and as close to the water's edge as possible. Usually, these traps were reset each night along a different (but contiguous) portion of the stream. However, lack of success during the first 2 months of trapping lead to speculation that water shrews could behaviorally avoid unfamiliar objects within their territory. Therefore, occasionally the traps were left in the same location for 2 nights in an attempt to address this possibility. Further, in an attempt to survey the small rodent communities in these riparian zones, large Shermann live traps (7.62 cm X 8.89 cm X 22.86 cm) were set every 5 to 7 meters in a line roughly parallel to each stream (except the West Fork of the Black River due to potential interference from campers) at a distance of between 5 and 25 meters from the stream bank. Both small and large Shermann traps were checked periodically throughout the evening and early morning to minimize trap deaths. Live animals were identified by species, gender, reproductive status (when possible) and then marked by toe clipping and released at the capture site. The cover provided by each stream was measured using the point-quarter sampling method at 10 locations along each drainage. Sampling points were located 100 meters apart (Cox, 1980). Measurements were obtained of the following vegetative characteristics in each quarter: 1) grass/herbaceous cover (by measurement to the nearest area > 1.0 m^2 grass/herbaceous ground cover of height > 20 cm), 2) willow/shrub cover (by measurement to nearest willow/shrub providing ground cover of > 2.0 square meters), and 3) trees of diameter at breast height of > 20 cm. Average distance, l, to each of

these vegetative characteristics was determined for each of the 10 linear sampling points along the streams. Density of these vegetative characteristics was then estimated as $D = 1/L$, where L constitutes the average distance to the measured characteristic at each of the 12 sampled riparian zones (i.e. average of distances, l).

RESULTS AND DISCUSSION

From 25 May through 19 September, 1993, a total of 3015 trap nights using small Shermann traps and 1840 trap nights using large Shermann traps was obtained at 12 riparian zones on 11 drainages in the Apache National Forest. Table 1 summarizes the elevation, vegetative characteristics, trap nights, and number of water shrews caught at each of these twelve drainages. Table 2 summarizes the location, elevation, date collected and number of water shrews caught for all water shrews trapped in Arizona through the fall of 1993. For an indication of the small mammal communities (excluding bats) of the 12 drainages sampled in 1993, see Tables 3 through 14.[1]

Only two water shrews were trapped during the 1993 trapping season. Both were taken at Sheep's Crossing on the West Fork of the Little Colorado River, marked and released at the trap site. Sampling at other sites of historical occurrence (Fish Creek (B), West Fork of the Black River, Phelps Cabin area) failed to confirm current distribution of ***Sorex palustris navigator*** on these drainages. It is interesting to note that all of the recent trappings of *S. p.* ***navigator***, have occurred from July 30 through September. What implications, if any, this may hold concerning the activity pattern of the water shrew in the Apache National Forest and the potential success of trapping efforts prior to the end of July is uncertain.

Given the limited number of water shrews caught in Arizona to date, it is difficult to assess the appropriateness of trapping methods used. In 1992, Hanna used pitfall traps to obtain four specimens, while Smith, in 1985 and 1987, and Hocutt, in 1993, used Shermann live traps to obtain an equal number. Factors affecting trapping success in Arizona may include activity patterns of the water shrew, limited distribution and difficulty of setting both pitfall and Shermann live traps effectively at stream banks.

Characteristics of the streams where ***Sorex palustris navigator*** have been trapped recently include high elevation (> 8000 ft.), perennial water, heterogeneous stream bank structure (observed) which may include overhanging banks, presence of tunneled banks, tree root cover and large rocks, and density of grass and herbaceous and/or willow and shrub cover of greater than 30% (as estimated by herbaceous/grass cover density plus 2 X willow/shrub density from Table 1). No measurements of the vegetative characteristics were made for sites not sampled in 1993 (KP Cienega, Horseshoe Cienega, Lee Valley Reservoir). Results of vegetative sampling for an estimate of the density of suitable vegetative cover may be interpreted in several

[1] Classification of microtine rodents within appendices 2 through 13 may be inaccurate due to inexperience of field workers especially at the beginning of the 1993 trapping season. Because most animals were trapped live and released thereafter, classification within these summaries probably contains some inaccuracies especially as regards *Microtus mexicanus* and *Microtus montanus*. The summaries as presented are based upon re-inspection of dead specimens from the same trapping season and a reevaluation of the original data kept on head/body and tail measurements and habitat characteristics where trapped.

ways. Assuming that the sampling performed gives a reasonably accurate measure of suitable water shrew vegetative cover, the suitability of the habitats sampled would largely be below optimum based upon Clark's findings that shrews most often occurred in his study area where cover was approximately seventy-five percent (Beneski and Stinson, 1987, citing: Clark, 1973). In such a case, even documented water shrew habitat in the White Mountains could be considered suboptimal. On the other hand, water shrew habitat in the White Mountains may never have been so densely covered or, the vegetative sampling technique may yield a different result from that used by Clark.

Sampling to date would indicate that the distribution of *S. p. navigator* may be limited to the Mt. Baldy Wilderness and surrounding areas including the neighboring area of the White Mountain Apache Reservation. Although the limited sample size and historical trapping sites imply that the range may extend to a few other high elevation areas of the Apache National Forest, conservative interpretation of recent data may require that management assume a more restricted present distribution of *S. p. navigator* until additional surveys can be completed. Until further surveys are undertaken to identify additional drainages which support populations of water shrews and to determine the linear extent of their ranges along each of the drainages, no accurate assessment can be made of the current range of the species.

MANAGEMENT IMPLICATIONS

Sorex palustris navigator currently exhibits a limited known distribution within the White Mountains region along perennial, high elevation streams within and around the Mt. Baldy Wilderness. Fortunately, the Mt. Baldy Wilderness is an area of limited commercial exploitation, and many of the streams coming off of the wilderness area exhibit many of the characteristics which are presumed to provide good habitat for the water shrew. Nevertheless, dispersal of water shrews is, in all likelihood, accomplished through stream channels. Therefore, it may be necessary that these favorable stream characteristics extend linearly along these streams well outside of the wilderness area in order to facilitate dispersal and gene flow within the population, thus minimizing the possibility of extinction through fragmentation and isolation of subpopulations. Agencies involved in the conservation of this form may wish to assess the vegetative and structural characteristics of the higher elevation perennial streams in the area in numerous places along the length of each stream. Measures to protect and/or enhance the quality of vegetative and structural characteristics can then be evaluated.

Without more complete information on the full range and population density of the water shrew in Arizona, the efficacy of any management efforts can only be speculative. Therefore, agencies involved may wish to conduct (or sponsor) additional surveys to evaluate existence of the water shrew at other high elevation perennial streams in the Apache National Forest (and Apache Reservation, if possible) and, thereafter, to evaluate the extent of its range linearly along streams where it is known to occur. Such data would provide much needed information on the full range of the species in Arizona and the extent to which subpopulations may be isolated.

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